

THE WATER WHEEL

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Water Security Africa

18 – 20 May 2009

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Mrs LB Hendricks, Minister of Water Affairs and Forestry, Extracted from an Address to the SADC Water Ministers Meeting, Mwanza, United Republic of Tanzania, 6 November 2008

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Barbara Hogan, Minister of Health, Quoted in The Times Online, 28 January 2009

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- **Dr. Marius Claasen**, Manager: Water Resources, **THE COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH**
- **Leonardo Manus**, Deputy Director: Water Services Technical Regulation, **DEPARTMENT OF WATER AFFAIRS AND FORESTRY, SOUTH AFRICA**
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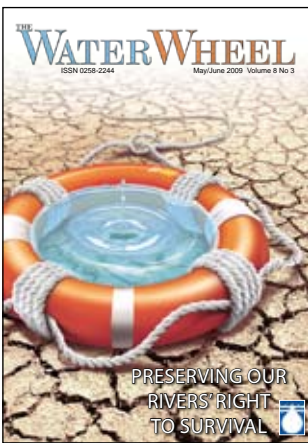


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Cover: Legislating and implementing our freshwater resources' right to water is the only way to ensure their survival.
 Cover illustration by Ralf Broemer.
 (See page 14).

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THE WATER WHEEL is a two-monthly magazine on water and water research published by the South African Water Research Commission (WRC), a statutory organisation established in 1971 by Act of Parliament. Subscription is free. Material in this publication does not necessarily reflect the considered opinions of the members of the WRC, and may be copied with acknowledgement of source.

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Fingers do the talking with new cellphone service

The City of Cape Town has launched an SMS service that allows members of the public to report problems or raise queries relating to municipal water and sanitation services.

The City reports that its call centre currently receives 30 000 to 40 000 customer calls per month. By rather sending an SMS, residents can report faults or ask questions without having to go through the call centre, which

will save them time, reduce call centre congestion, and shorten queuing time for operators.

All that is required in the SMS is the customer's name, Erf number and/or account number, street address and a brief description of the fault. Cape Town's technical operations centre will then log the complaint for remedial action and respond to the sender with a reference number.

The messages are received by the municipality in the form of an e-mail, which is then logged on the standard notification system, and dispatched to the relevant operational response team for action.

An SMS of no longer than 160 characters can be sent to 31373. SMS's cost 80c.

Report explores benefits from cooperation on transboundary waters

The Stockholm International Water Institute (SIWI) has issued a report detailing an analytical framework for effectively developing transboundary water resources in a responsible manner.

The report, *The TWO Analysis – Introducing a Methodology for the Transboundary Waters Opportunity Analysis*, outlines an approach by which transboundary water stakeholders can collaborate on the equitable and sustainable use of jointly held freshwater resources. It sets out a methodology for optimising benefits for development and economic growth and clarifies tradeoffs in developing transboundary water resources.

"TWO analysis can enable nations and regions to focus on developing benefits from their jointly shared water resources rather than just competing for access and volume," said SIWI Executive Director Anders Bertell. "We believe that it could be a highly practical tool to promote regional cooperation and, thereby, aid in conflict prevention."

The TWO framework helps stakeholders understand both opportunities and tradeoffs in four key areas, including hydropower and power trading, primary water use in agriculture, urban growth and industry, and environmental and ecosystem services. Water sources include development of potential 'new water' from such sources as desalination or wastewater reuse, as well as more efficient use of existing water sources.

"We developed the framework for practical application by water sector managers, government officials, regional economic planners, financial officers, and philanthropic organisations who need to make informed decisions about policy and infrastructure investments in transboundary water basins," noted Dr Anders Jägerskog, project director at SIWI and co-author of the report.

The TWO analysis framework and report was developed by SIWI in collaboration with the CSIR of South Africa and Phillips Robinson & Associates from Namibia. Funding for the project was provided by the Swedish Ministry of Foreign Affairs with support from the Swedish International Development Cooperation Agency, the Water Research Commission, the Swedish Research Links Programme and the Global Environment Facility of the World Bank.

More money for water and sanitation challenges

The Department of Water Affairs & Forestry (DWAF) will be providing an additional R500-million in the next financial year (2009/10) to deal with the immediate challenges with regards to the provision of water and sanitation.

This is on top of the funding provided to provincial and local governments through the Municipal Infrastructure Grant and the Bulk Infrastructure Grant.

"Government is fully committed to the 2014 universal access target and we are working across departments and other spheres of government towards the achievement of this target," reported Health Minister Barbara Hogan on behalf of the social cluster of government departments in a media statement in March.

During the present term of government an additional 1,465 million households have been provided with basic access to water supply, and another

1,16 million with basic sanitation.

In addition the schools programme has served 51 schools with water facilities and 125 with sanitation in the last financial year. "Though implementation was slow initially, progress has improved and the remaining 3 035 schools will be addressed by December 2010," noted Hogan. This will mean that all schools in South Africa will have basic access to water and sanitation.

Meanwhile, Minister of Water & Forestry Lindiwe Hendricks commissioned a new package water treatment plant worth R3-million for the community of Bothashoek village in the Tubatse Local Municipality, Limpopo, in March. The water treatment plant is part of government's intervention to stem the recent outbreak of cholera in the area.

During her visit the minister led a delegation of provincial and local politicians on a door-to-door health and hygiene education initiative.



Blueprint drawn up to ensure water future

The World Wildlife Fund for Nature (WWF) has called on the South African government, private sector and civil society leaders to join hands in an effort to avert a potential future water crisis in the country.

The non-governmental organisation has launched what it calls a 'blueprint' outlining specific actions to ensure that healthy freshwater ecosystems underpin economic and social well-being in South Africa. "It is time to move beyond alarm to practical action," reported Dr Deon Nel, head of the WWF Sanlam Living Waters Partnership. Speaking at the launch in March he said: "Water links all our futures in this country and we need to realise that we have a responsibility and ability to act in a way that will improve the health of our freshwater ecosystems."

According to the WWF, South Africa is at a particularly challenging environmental, socio-political and economic growth nexus. Government

is still focused on addressing the injustices of the past and ensuring basic services for all its citizens. The provision of water and sanitation services to the poor has increased the costs of preventative maintenance of related infrastructure and has posed new challenges for local government.

Meanwhile, economic demands are placing increasing demands on already limited water resources, resulting in the need to build more bulk water infrastructure. To complicate matters, climate change is likely to reduce water availability in South Africa.

The WWF Blueprint reveals ten actions for government, private sector and civil society. Actions for government include investing in the building of necessary skills to tackle the challenges, implementation of pragmatic and adaptive management approaches, and improved planning so that timely and informed investments can be made in infrastructure. The document also points out the importance of investing timeously

in other measures besides bulk water infrastructure such as curbing illegal water demand as well as water conservation and water demand management.

Key actions proposed for private sector are partnering with government to give effect to policies and legislation, and fostering corporate stewardship for water. "Big business has a vital role to play in ensuring economic growth, but it must play a stronger role helping to protect the functioning of aquatic ecosystems." Companies such as Sanlam, South African Breweries and Woolworths have already joined WWF's Water Neutral Programme.

The organisation also suggests actions for civil society, such as using market pressure to incentivise water wise behaviour. Finally, it calls on all people in South Africa to take responsibility for the way they use water and waste services.

"South Africa can avoid a water Eskom but only if we remain vigilant to a number of key threats."

Berg River Dam named after Khoi leader



The Berg River Dam will in future be known as Autshumato Dam.

Earlier this year the dam was renamed after the 17th century Khoi leader, better known as 'Harry the Strandloper', by South African President Kgalema Motlanthe. The Khoi leader was the first prisoner to be banished to Robben Island.

Motlanthe noted that the name change, which still had to go through the required legal processes, would go a way towards correcting historical injustices perpetrated against the Khoi, who had been "written out of history."

The Berg Water Project comprises the dam with a storage capacity of 130 million m³, a supplement scheme, two pump stations and 12 km of pipeline. It started storing water in July 2007 and, a year later, was full thanks to good rainfall. The

concrete-faced, rockfill dam is 250 m above sea level. It consists of an embankment of rock mined from the river bed and surrounding area, with an impermeable 300 mm layer of concrete on the upstream side. The dam wall is 68 m high and 929 m long.

WATER ON THE WEB

<http://en.cop15.dk/>

This is the official website for the United Nations Climate Change Conference, which will take place in Copenhagen, Denmark, in December.

www.phosphorusfuture.net

This is the official website of the Global Phosphorus Research Initiative (GPRI), a collaborative effort between the Institute for Sustainable Futures at the Sydney University of Technology and the Department of Water and Environmental Studies at Linköping University, Sweden. The main objective of the GPRI is to undertake quality transdisciplinary research on sustainable global phosphorus resources for food security.

STUDENT SOUGHT FOR PROJECT

A student is urgently being sought to participate in a Water Research Commission funded project on the development of a diatom-based bio-monitoring protocol for South African rivers and streams. This study is dealing with the formulation and calibration of a diatom index for South Africa. For more information, contact Dr Bill Harding of DH Environmental Consulting at Tel: (021) 855-2528 or e-mail: bill@dhec.co.za

WATER DIARY

**WATER HISTORY
MAY 28-29**

The IWA conference on Water and Wastewater Technologies in Ancient Civilisations will be held in Bari, Italy. *Enquiries: Renato Drusiani; Tel: +39 0647 865 620; Fax: +39 0647 865 625; E-mail: acqua@federutility.it; Visit: www.federutility.it*

**MICROBIOLOGY
MAY 31-JUNE 5**

The 15th International Symposium of the IWA Health-related Water Microbiology Group will be held in Naxos, Greece. *Enquiries: Alexandra Manou; E-mail: info@watermicro2009.gr; Visit: www.watermicro2009.gr*

**ENVIRONMENTAL SCIENCE
JUNE 2-5**

The 8th Worldwide Workshop for Young Environmental Scientists will be held in Paris, France, with the theme 'Urban water: Resources and Risks, a

Developing Country's Perspective'. The workshop will combine natural and social sciences to improve transdisciplinary discussions and social commitment of scientific research in the field of integrated water resource management. *Enquiries: Martin Seidl; E-mail: martin.seidl@h2o.net; Visit: www.yes.h2o.net*

**TECHNOLOGY
JUNE 9-11**

The International Water Technology Exhibition and Conference, WaterTec Africa, will be held at Gallagher Convention Centre in Midrand. The event is co-located with Pumps, Valves & Pipes Africa and endorsed by WISA. *Visit: www.exhibitionsafrica.com or www.fairconsultants.com*

**WATER TREATMENT
JUNE 14-18**

The American Water Works Association Annual Conference & Expo will take place in San Diego. *Enquiries: Cilia Kohn or Tricia Loughhead; E-mail: awwamktg@awwa.org; Visit: www.awwa.org/ace09*

**NEW TECHNOLOGIES
JUNE 23-25**

The 6th IWA Leading-Edge Conference on Water and Wastewater Technologies will take place in Singapore. *Enquiries: +31 703 150 793; E-mail: let2009@iwahq.org; Visit: www.let2009.com.sg*

**EDUCATION & TRAINING
JUNE 24-25**

The 1st WISA Education Conference will be held at the Feathermarket in Port Elizabeth. *Enquiries: Dot Zandberg; E-mail: conference@wisa.org.za*

**WATER ECONOMICS
JULY 3-5**

The 2nd IWA International Conference on Water Economics, Statistics, and Finance will be held in Alexandroupolis in Greece. *Enquiries: Konstantinos P. Tsagarakis; Tel: +30 28310 77433; Fax: +30 28310 77406; E-mail: iwa@econ.soc.uoc.gr; Visit: www.soc.uoc.gr/iwa*

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Increased human 'wants' world water's biggest threat

Humans' desire for the material luxuries of a better life could be the death knell of our precious water resources and fragile aquatic ecosystems, according to the latest United Nations World Water Development Report.

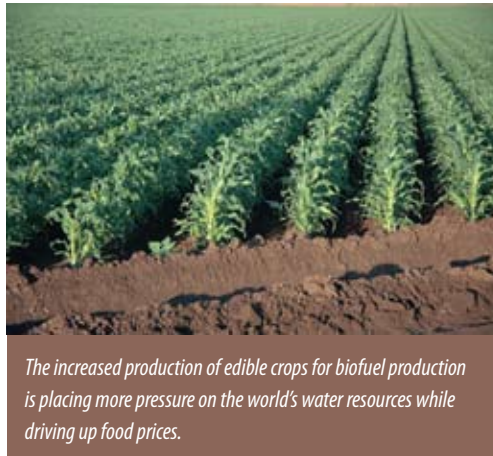
Over the last few decades countries around the world have placed much emphasis on the provision of basic services and the eradication of poverty and joblessness in communities. Massive social and economic changes taking place in many developing countries are lifting millions of people out of poverty and creating a new middle class with increasing demands for food such as milk, bread, eggs, chicken and beef to complement their traditional and less water-intensive diets.

Once their basic survival needs are met, people's requirements for increased comfort and convenience become more prominent, resulting in a rising consumption of material goods and non-essential services such as travel and leisure. This is coupled with a world population growing by some 80 million people a year, implying increased freshwater demand of about 64 billion m³/year.

According to the UN report, *Water in a Changing World*, released in March, this desire for a better lifestyle is arguably one of the most powerful human motivations, and the rapid global rise in living standards, combined with population growth poses the major threat to the sustainability of water resources and the environment. "As standards of living rise in developing countries and countries undergoing economic transition, the demand for larger homes and for luxury items such as kitchen appliances, cars and the energy to run, heat and/or cool them is increasing the demand for resources required to produce, generate and operate them," say the authors of the report.

"The production of goods to satisfy these growing human wants is often not possible without the overuse of natural resources. The major challenge is to reconcile human needs and human wants with the ability of nature to provide or replenish the resources to produce them. Global society must address the dual goal of enhancing human well-being and lifestyles while ensuring the sustainability of the ecosystems and environmental conditions that provide the desired goods and services."

Achieving this goal will prove impossible unless humans recognise and better understand the links between their actions and the condition and sustainability of the natural environment. The



The increased production of edible crops for biofuel production is placing more pressure on the world's water resources while driving up food prices.

report points out that raising awareness to bring about behavioural change is one approach, but a still elusive goal.

It is also noted that human wants and needs drive technological innovation, which could both be beneficial or detrimental to the world's freshwater. Some new technologies can have positive spinoffs – reducing water demand and increasing available water (for example, rainwater harvesting) – while others can increase water demands (such as using crops to produce bioenergy).

Several important technological trends are observed which could have important impacts on the global water sector:

Environmental research and development:

Many countries have increased their investment in environmental research and development to encourage new technologies to improve environmental quality.

Renewable energy: Innovation in renewable energy has accelerated in response to recent public and political pressure to reduce greenhouse gas emissions thought to be contributing to global climate change.

Information and communication technology (ICT): Advances in ICT can affect the cost and effectiveness of monitoring ecosystem health and quality. Reductions in the costs of sensors, coupled with satellite-based wireless data transfer, have greatly facilitated the monitoring of water resources and the delivery of water-related services, all in real time.

Biotechnology and genetically modified organisms: Plant and animal breeding has increased agricultural productivity and therefore affected water productivity. Progress has been concentrated in crop and animal productivity and resistance to pests, disease and weather extremes. With regards to genetically modified organisms, microorganisms are an especially promising avenue. As decomposers of organic material, they are capable of breaking down or otherwise neutralising many types of polluting material in the environment.

Bioenergy: Bioenergy, derived most commonly from plant materials, is a renewable energy source that is less likely to increase carbon dioxide emissions that contribute global warming. This technology is not without its challenges, however. Most notably, producing bioenergy from crops traditionally grown as food (such as maize) will require additional agricultural production to make up for the lost food sources, and more water as well.

Nanotechnology: Nanotechnology has the potential to greatly improve water quality and quantity through water treatment or remediation. Key areas are desalination, water purification, wastewater treatment and monitoring. Nanotechnology

This latest World Water Development Report, the third published since 1999, provides a comprehensive analysis of the state of the world's freshwater resources. It also, for the first time, shows how changes in water demand and supply are affected by and affect other global dynamics.

"Water is a cross-cutting issue that demands a coordinated approach," said Koïchiro Matsuura, Director-General of the UN Economic, Scientific and Cultural Organisation (UNESCO). "Our success in avoiding a global water crisis is directly linked to our ability to address other global challenges from poverty eradication and environmental sustainability to fluctuating food and energy costs and financial turmoil in world economies. It is therefore imperative that global risks, including those associated with water, be dealt with in an integrated manner."

To access the full report, go to <http://webworld.unesco.org/water/wwap/wwdr/wwdr3/index.shtml>

Hope for Africa's green heart

A World Wetlands Day announcement that Gabon is to increase its protected Ramsar sites by more than a million hectares is a major boost to conservation in central Africa, reports WWF.

The addition of the three new areas totalling 1 054 700 ha to the Ramsar register of wetlands of international importance will increase Gabon's total area of Ramsar protected areas by more than a third. "The green heart of Africa is a global conservation priority, and the basis of the region and its biological wealth are its rivers and wetlands," says Dr Lifeng Li, Director of WWF International's Global Freshwater Programme. "These new areas cover diverse habitats from impressive river rapids to extensive marshes and are vitally important to the wildlife and people of the region."

The largest of the areas is the 862 700 ha Bas Ogouvé, a luxuriantly vegetated area of alluvial plain, lakes, marsh and rivers in western Gabon which is home to gorillas, chimpanzee, elephant, buffalo, the African manatee and hippopotamus. World Wetlands Day is held on 2 February each year. *Source: WWF*

Helping poor communities adapt to changing climate

A new global initiative will generate and share knowledge on strategies to help the world's poorest and most vulnerable communities adapt to the impacts of climate change.

According to online news agency SciDev.Net, the Global Initiative on Community Based Adaptation to Climate Change, will be made up of representatives of donor agencies, research institutes and non-governmental organisations from 50 countries.

The initiative will support an online platform, Community Based Adaptation Exchange, where stakeholders can share experiences and information about the kind of adaptation strategies that work best – and could be replicated and scaled up elsewhere. They will hold a number of conferences to share best practice, with the first in Tanzania in September.

The importance of the need to use simple, low-cost technologies to



enable poor communities to cope with climate change has been stressed. However, according to Ian Burton, professor emeritus at the University of Toronto, Canada, adaptation should not only focus on short-term palliative adaptation strategies that yield immediate results. "It is important to avoid maladaptation or adaptation that will make the situation worse in the long term as we are focused on what will work in the short term."

Potential adaptation techniques include crop varieties that can tolerate drought, floods and high salinity; drip and other irrigation techniques to conserve scarce water; building storm and cyclone shelters; changing crop growing cycles; and diversifying from crops to fish, shrimp, crab and livestock farming.

Trust races to build endangered food seed bank

The Global Crop Diversity Trust has announced that it is on track to save from extinction 100 000 different varieties of food crops from 46 countries, making it one of the largest and most successful biological rescue efforts ever undertaken.

"We are moving quickly to regenerate and preserve seed samples representing thousands of distinct varieties of critical food crops such as rice, maize, and wheat that were well on their way to total extinction," reported Cary Fowler, Executive Director of the Trust. The organisation, based in Chicago, in the US, started its ambitious project two years ago.

In many countries, stresses as mundane as poor refrigeration and inadequate funding and as dramatic as war and economic collapse threaten seed collections and crop varieties that do not exist anywhere else in the world. The imperilled seeds targeted for rescue by the Trust are samples of staple crops stored in crop gene banks in Africa, Central Asia, South Asia and Central and South America. They include rare varieties of barley, wheat, rice, banana/plantain, potato, cassava, chickpea, maize, lentil,

bean, sorghum, millet, coconut, breadfruit, cowpea and yam.

According to Fowler, the Trust already has agreements in place with 49 institutions in 46 countries to rescue some 53 000 of the 100 000 crop samples identified as endangered. Agreements for preserving the remaining varieties are expected to be completed soon. The initiative is one of the biggest rescue efforts ever of any threatened biological species and by far the largest rescue of endangered domesticated crop varieties.

More investment in agriculture required to avert global food crisis

National governments should reinvest in agriculture and associated infrastructure.

This is according to Dr Chandra A Madramootoo, Dean of the Faculty of Agriculture and Environmental Sciences at McGill University in Canada. He was delivering the 7th ND Gulhati Memorial Lecture for International Cooperation in Irrigation and Drainage at the last international conference held in Pakistan.

During the last four decades the crop area harvested has hardly increased, while the world cereal production has increased more than twofold. Despite this increase, close to a billion people still remain malnourished, of which some 800 million live in least developed countries.

According to Dr Madramootoo, there has been growing concerns over declining irrigation system performance and investment benefits, especially in large-scale public irrigation schemes. Improvement in both conveyance efficiency and on-farm management was a key for increasing the overall irrigation efficiency, he noted. "Efficiency gains of 14% in gross withdrawal can also be achieved through reuse of return flows. Improved surface irrigation methods like level furrows, sprinkler and micro-irrigation methods and use of advanced techniques of irrigation scheduling can help improve on-farm water management."



Childhood diarrhoea research needs 'ignored'

Childhood diarrhoea research needs a radical change of direction to reduce the death rate from a 1.8 million a year, say experts.

Online news agency SciDev.Net reports that an international survey found that experts

are far more concerned about why effective treatments are not getting to those who need them than they are about research into new products – yet the subject attracts only 3% of diarrhoea research funding. The research, published in *PLoS Medicine* (an open access journal published online by the Public Library of Science) sought to determine – and guide researchers and funders about – which research avenues should be urgently pursued to meet the millennium development goals to reduce childhood mortality by two-thirds by 2015.

Olivier Fontaine, lead author of the research, asked experts from a range of fields to suggest



research questions related to childhood diarrhoea and how to reduce deaths by 2015. These were then assessed and ranked using criteria such as their affordability.

Top priorities

were found to be health systems research into how to deliver cheap and effective treatments such as oral rehydration and zinc tablets, and health messages such as the role of exclusive breastfeeding in preventing diarrhoea. Fontaine found that 97% of research funds instead go to the development of new diarrhoea products. He claims researchers are attracted to product development because they can gain patents and visibility from it.

To access the full paper, go to <http://medicine.plosjournals.org/perlserv/?request=get-document&doi=10.1371/journal.pmed.1000041>

Move to revive ailing Iraqi marshlands

The Iraqi government and a number of United Nations (UN) agencies have launched a US\$47-million initiative to remove dykes and canals built by the regime of former President Saddam Hussein so that water can flow back into marshland areas.

The aim is to help the government strengthen services, build better governance systems and develop agriculture and public services in these areas, according to IrinNews. "People living in the marshlands are some of the poorest and most badly provided with services," noted David Shearer, UN deputy special representative of the Secretary-General, in a statement.

Reviving Iraq's marshlands, the largest wetland ecosystem in the Middle East, is an urgent environmental and humanitarian task which will need national, regional and international efforts, a local officer said. The marshlands, with their once rich biodiversity, have been damaged significantly since the 1970s due to upstream dam construction and drainage operations by Saddam's regime.

Other problems include water quality degradation caused by sewage, high levels of salinity, and pollution from pesticides and untreated industrial effluent; many people have been displaced. The UN Environment Programme and the UN/World Bank Needs Assessment Initiative for the Reconstruction of Iraq have identified damage to the marshlands and the resultant displacement as a major disaster.

"Billions of dollars are needed to implement projects to maintain livelihoods for the inhabitants. Also needed is cooperation by both Turkey and Iran to release more water to Iraq," Hamid al'Dhalimi, a member of Basra Provincial Council and head of the Marshlands Committee, said. "Low water levels mean high levels of salinity and this affects papyrus, reeds, fish, birds and cattle which are essential for the inhabitants' lives...water levels have reduced to almost half since 2003," he noted.

The government has been spending US\$50-million a year since 2006 to boost marshlands livelihoods, but recent falls in the water level have forced returnees to leave the area once more.

Global news in brief

Water district officials in Orange County, California, in the USA, are testing a **groundwater replenishment system**, which recycles wastewater using microfiltration, reverse osmosis, ultraviolet and hydrogen peroxide disinfection. The system is said to be the largest of its kind, and can treat around 70 ML of groundwater a day. Treated water will be pumped into the local aquifer to then be abstracted for drinking water.

Researchers from Duke University in the USA have found that **ancient underground wells** in water-deprived Jordan have 20 times more radiation than is considered safe for drinking. Their study showed that water from an underground source in Jordan contained high levels of a naturally occurring radioactive particle linked to some cancers, posing a health risk to thousands of people who drink it.

China is planning 59 reservoirs to collect water from the country's **melting glaciers** in an attempt to soften the effects of climate change. The western province of Xinjiang will undertake the ten-year project, which will intercept and store glacier meltwaters.

The inhabitants of a small town north of Quebec, Canada, have launched a **class-action suit** against the federal government after discovering their water supply was contaminated with trichloroethylene, a potential carcinogen, used to clean cannons at the nearby Valcartier Canadian Forces base. The runoff from the cleaning process ran into Shannon's water table.

The Coca-Cola Company has committed US\$30-million over the next six years to provide **access to safe drinking water** to communities throughout Africa through its Replenish Africa Initiative (RAIN). Implemented by the company's Africa Foundation, RAIN will provide at least two million Africans with clean water and sanitation by 2015.

Japan has announced financial assistance worth US\$5.6-million for the extension of grant aid for the implementation of a project to improve equipment for **groundwater development** in Ethiopia.

Women in the Machar Colony, the largest slum in the Pakistani city of Karachi, are refusing to use chlorine tablets to purify water because their husbands fear it will make them **impotent**. The slum houses 700 000 residents, there is no gas or electricity and the only water source is polluted.

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This course is aimed at scientists and technologists involved in waste management and aims to equip them to evaluate technical and legal aspects of waste handling and disposal, and to make informed decisions about waste handling and disposal.

Course cost: R 3 700

OPERATION OF WATER AND WASTEWATER TREATMENT PLANTS

06 – 10 July 2009

The main objective of this course is to provide the course participants with adequate theoretical and practical knowledge about water and wastewater treatment and the operation of treatment plants. This will enable them to make informed decisions about drinking water treatment processes and the quality of drinking water; wastewater treatment processes, effluent quality and disposal of effluents and evaluate the operation and control of water and wastewater treatment plants.

Course cost: R 6 900

WATER QUALITY MANAGEMENT AND EFFLUENT TREATMENT

17 – 21 August 2009

The main objective of this course is to provide the delegate with adequate theoretical and practical knowledge about water quality, and water and wastewater treatment so that they will be able to make informed decisions about treatment and disposal of effluents and evaluate the operation and control of water and wastewater treatment plants.

Course cost: R6 900

MEMBRANE PROCESSES

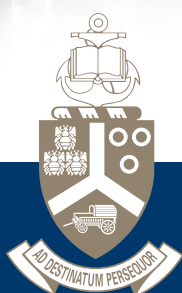
19 – 21 October 2009

This 3-day short course provides the participant from the Engineering environment with sufficient information on all aspects of membrane processes to make informed decisions about the application and operation of reverse osmosis (RO), nanofiltration (NF), ultrafiltration (UF), microfiltration (MF) and electrodialysis (ED/EDR) for water desalination and industrial water treatment.

Course cost: R4 600

For more detailed information please go to:
<http://www.up.ac.za/academic/water/>

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State infrastructure spending helps firms in tough times

Government's decision to maintain large-scale infrastructure investment despite the current tough global economic climate is a life saver for many firms in the consulting engineering industry.

According to Consulting Engineers South Africa (CESA) President Felix Fongoqa, consulting engineers should appreciate government's infrastructure development programme as it will keep the industry on track during present tough times. "CESA welcomes the budget news that spend on infrastructure will reach close to R800-billion over the next three years and finds it encouraging that government has prioritised Eskom, housing, water and sanitation and the Expanded Public Works Programme," said Fongoqa.



CESA President Felix Fongoqa with CE Graham Pirie

CESA plans to partner with government in ensuring that their investment objectives are realised. Fongoqa states: "Engineers are innovators that can rise to the challenge of ensuring that their designs allow for maximum use of labour during construction and that the ideal of sustainable development is achieved."

He is, however, concerned about the negative consequences of not focusing on the maintenance of existing infrastructure, particularly in the local government sphere, which has resulted in some municipal water and wastewater treatment works malfunctioning.

Test strip kits offer easy testing for algal toxins

International company Abraxis has released a much-needed addition to the tests available for cyanobacterial toxins.

Two new 'test-strip' products, these being the immunochromatographic strip tests for the detection of microcystins and nodularins in raw potable and recreation waters, with detection limits of up to, respectively 1 ppb and 10 ppb. The recreational kits are provided as sets of five or 20 tests. Kits are packaged in easy and read-to-use format for field application.

Local evaluations to underpin the validity of these products for South African use were successfully undertaken by the Nelson Mandela Metropolitan University in Port Elizabeth. The strips were tested at 14 dams.

Of the 14 dams sampled, three had significant cyanobacterial biomass. Two of these were positive for microcystin using test strips.

The university reports that the sensitivity and accuracy of the test strips were excellent. "We accordingly consider this product extremely valuable and support its use for general testing of potable and recreational waters where conventional methods are not available," the university said in a statement.

The availability of these tests now provides the ability to rapidly undertake toxin tests across a wide range of potentially-impacted water types – and precludes the often-lengthy delays between sample collection and the results of laboratory analysis. Additionally, veterinary officers and agricultural advisors are now able to conduct 'on the spot' testing in rural and farm environments.

The test strips are not available from local suppliers at present. For more information, visit: www.abraxiskits.com

Dry toilet system provides safe sanitation to thousands

More than 48 000 Enviro Loo on-site dry toilet systems have been installed since 1993.

According to manufacturer Enviro Options, while the award-winning toilet system was developed in South Africa and is still predominantly manufactured locally, it is now produced in other countries and distributed to 39 states. It is installed in urban and rural areas, schools, clinics, ecologically sensitive areas, camp sites and national parks.

The toilet requires only wind and radiant heat to function and works by separating liquid and solid waste as it enters the container via the custom-

designed ceramic toilet bowl. Liquid waste drains to the bottom of the container while solid waste remains on the drying plate. Both the liquid and the solid waste are exposed to a continuous flow of air that is driven through the unit by the forced aeration ventilation system. The movement of air is assisted

by the ventilation extraction unit positioned on top of the outlet vent pipe with air being drawn into the container via the inlet pipes and toilet bowl.

The negative pressure within the container prevents the escape of any odour through the toilet bowl or through the air inlet pipes. The odour is vented into the atmosphere via the wind-driven extractor. The human waste is converted, via the stimulated bacterial and biological activity, into an inoffensive dry stabilised material. At this point it is reduced to roughly 5% of its original volume.



**Report No: TT 366/08****Membrane-related Water Research Impact Assessment (Frost & Sullivan)**

Water-related membrane research in South Africa has, to a large extent, been driven through funding made available by the WRC. This research has resulted in increased awareness, utilisation and a better understanding of the applications for membranes in South African conditions. The aim of this document is to highlight the impact of these membrane-related research activities and their benefit to South Africa. These benefits are broadly classified according to the economic, social, health and environmental impacts that the research has had upon the South African population.

Report No: 1079/1/08**Research on an Investigation into Sulphur Chemistry with Specific Application to Biological Sulphate Removal Processes (RE Loewenthal; B Morgan; O Lahav and G Hearne)**

The principal aims of this project were to investigate and model a sulphide chemistry on both aqueous and gaseous phases; to investigate and model the recovery of elemental sulphur through chemical oxidation of sulphide; and to investigate and model the precipitation and recovery of metals. With regard to sulphide chemistry, this is complex and governed by both weak acid and redox reactions.

In acid mine drainage, this is further complicated by the co-existence of both the carbonate, hydroxide and base systems. The only reasonable approach to understanding is via equilibrium chemistry. This is

New from the WRC

effected here in a clear and didactic fashion, using graphical approaches effected in so-called equilibrium diagrams.

Report No: 1774/1/08**Scoping Study to Determine the Potential Impact of Agricultural Chemical Substances (Pesticides) with Endocrine Disruptor Properties on the Water Resources of South Africa (A Burger and A Nel)**

Some pesticides used in agricultural practice have endocrine disruptive (ED) properties which may contaminate South African water resources. Concern has been expressed that some of these pesticides may enter and pollute the rivers and dams and cause ED effects in animals and humans that use the water for drinking and recreational purposes. It is, however, not clear what the impact of these chemicals or their breakdown-products is on the water resource. The main objective of this study is to gather information to determine whether a larger study is justified to establish the impact of pesticides with ED properties in water systems of the country.

Report No: 1441/1/08**Membrane Fouling and Visualisation Studies (FJ Reinecke; DS McLachlan; MB Mbanjwa; J Ali and RD Sanderson)**

UTDR is a relatively recent and versatile in-situ, non-invasive measurement technique in real-time, which offers the possibility of monitoring the growth of a fouling layer online. The main aim of this research project was to apply the UTDR technique to describe membrane fouling that occurs in water purification plants. The basic goals were to obtain an improved method by which to visualise the initial growth of the fouling layer in-situ and to develop a technique that could be used to avoid, or at least reduce, membrane fouling, while monitoring the efficiency of such a technique by means of a non-invasive visualisation technique. It was envisaged that if fouling could be slowed down in the early stages then it could be reversible.

Report No: 1461/1/08**Assessment of the Interaction between Cage Aquaculture and Water Quality in Irrigation Storage Dams and Canal****Systems (K Salie; D Resoort; D du Plessis and M Maleri)**

The aim of this study was to evaluate the potential use of open water systems, storage dams and canal systems, in particular, for cage aquaculture development. The addition of aquaculture into existing water structures can increase the production output per litre dam water, but only if aquaculture does not jeopardise the primary uses of these water bodies.

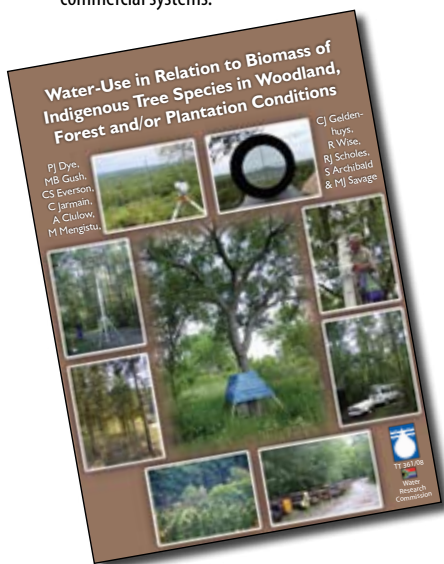
**Report No: TT 363/08 & 1301/1/08****Improvements to the ACRU Salinity Model and Upgrading of the Berg River Water Quality Information System and Technical Instruments to Support Water Quality Use Allocation (JN Rossouw; W Kamish; F Clark; and AHM Görgens)**

The National Water Act prescribes the minimum components of a catchment management strategy and prime among these are the formulation of water allocation principles and a water allocation plan for each water management area. This project was proposed to focus on a very particular part of the water allocation challenge, namely the allocation of water quality use. An objective of the project was to effect a process of 'learning-by-doing' by applying the framework in a stressed catchment with water quality concerns. For this purpose the ACRU Salinity models were applied to the Berg River catchment.

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Report No: 1369/1/08***Development of a Membrane Pack for Immersed Membrane Bioreactors (VL Pillay & EP Jacobs)***

An immersed membrane bioreactor (IMBR) incorporates membrane filtration technology in a bioreactor to provide a single unit for biological treatment and high-quality effluent production. IMBRs offer various advantages over the conventional activated sludge process for wastewater treatment as it is a compact process with a small footprint; operates at an elevated biomass, has increased sludge age and reduced sludge production, among others. This project concerned the development of an inexpensive MBR technology for smaller scale applications that could fill the economic void left by the current commercial systems.

**Report No: TT 361/08*****Water Use in Relation to Biomass of Indigenous Tree Species in Woodland, Forest and/or Plantation Conditions (PJ Dye; MB Gush; CS Everson; C Jarmain; A Clulow; M Mengistu; CJ Geldenhuys; R Wise; RJ Scholes; S Archibald and MJ Savage)***

Large areas of commercial forest plantations occur in the wetter regions of South Africa. While they contribute considerably to the economy and employment, the evapotranspiration from these plantations is substantially higher than from the original grasslands or fynbos that were replaced by afforestation. Thus, forest plantations have reduced catchment water yields in most areas. There is a widespread perception within South Africa that indigenous tree species, in contrast to the exotic pines, gums and wattle, are water-wise and deserve to be planted more widely in view of their more efficient use of

water. The overall aim of this project, which was co-funded by Working for Water, was to investigate rates of growth and water use by a wide selection of indigenous tree production systems and to make economic and hydrological comparisons to present commercial forestry systems.

Report No: 1542/1/08***The Removal of Reactive Dyes from Dye Liquor using Activated Carbon for the Reuse of Salt, Water & Energy (Z Mboleka and CA Buckley)***

The textile industry is characterised by high water consumption and is one of the largest industrial producers of wastewaters. Textile effluents from cotton dyeing represent severe environmental problems as they contain highly coloured and high conductivity wastewater resulting from dye baths and dye rinse waters, which contain unfixed dyes. The aims of this project were to establish the process parameters governing the recovery of water and chemicals for reuse from reactive dye baths using activated carbon and develop an economically viable process using activated carbon for recovering water and chemicals from reactive dyeing.

Report No: 1594/1/08***The Generation of Design Parameters for the Use of the Limestone Teeter Bed Reactor for Potable Water Stabilisation and the Treatment of Cape Coloured Waters (RG Batson)***

The main aims of this project were to demonstrate the use of the limestone teeter bed reactor in the treatment of Cape coloured waters and the stabilisation of soft, corrosive surface waters. The project also focused on developing design parameters for the construction of full-size plants based upon the application of limestone teeter bed technology.

Report No: 1581/2/08***An Intermediate Ecological Reserve Determination Study of the East Kleinemonde Estuary (L van Niekerk; GC Bate and AK Whitfield)***

The East Kleinemonde Estuary is situated about 15 km northeast of Port Alfred, in the Eastern Cape. The report features the findings of the East Kleinemonde Intermediate Ecological Reserve Determination Study. The study was undertaken for the Resource Directed Measures Chief Directorate of the Department of Water Affairs & Forestry as part of the WRC project on temporarily open/closed estuaries in the Eastern and Western Cape.

WATER BY NUMBERS

2 000 – The number of women engineers registered with the Engineering Council of South Africa. The figure has doubled since 2006.

98% – The percentage of bucket toilets eradicated in the Eastern Cape, according to Premier Mbulelo Sogoni. In his state-of-the-province address in February he said the province was working closely with the Department of Water Affairs & Forestry (DWAF) to eliminate the remaining 2%, constituting 1 400 bucket toilets in Tarkastad and Indwe.

88% – The percentage of households who had access to potable water in 2008, up from 62% in 1996, according to the South African government. Access to sanitation has increased in the same period from 52% to 73%.


1,4-billion – The number of people who live in river basins where their use of water exceeds minimum recharge levels, leading to desiccation of rivers and the depletion of groundwater, according to the United Nations.

258 555 – The number of households still lacking access to safe water services in Mpumalanga.

12 332 – The number of bucket toilets eradicated in Gauteng. According to Gauteng Local Government MEC Qedani Dorothy Mahlangu, the province is on track to meet the 2010 sanitation and 2012 electricity targets.

1 890 g – The grams per ton of gold found in the incinerated sludge ash at a wastewater treatment facility in Japan. An official in Nagano prefecture, northwest of Tokyo, said the elevated levels were probably due to the many precision equipment manufacturers in the area that use gold in their systems.

£125 000 – The fine handed down to Thames Water in the UK for a pollution incident in which a large quantity of high-strength chlorine spilled into the river from the company's Beddington wastewater treatment works in September 2007, killing nearly all of the fish and other creatures in the Wandle River. The spillage undid 20 years of restoration work on the river.



GOVERNMENT LEADERS SLOW TO RESERVE WATER FOR ENVIRONMENT

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Many Fear Decisions Won't Stand up in Court

While the world's eyes have gradually opened to the importance of maintaining adequate water flows in rivers and streams to sustain aquatic environments, acting upon this need has proven a slow and challenging process. Lani van Vuuren reports.

Historically, infrastructure developments around the world have taken the requirements of downstream ecosystems (and often the people who depend on the services of these ecosystems) for granted. Examples abound in most countries, including South Africa, where the water needs of people have in the past been met to the detriment of aquatic plants and animals.

"We have emerged from a century of building dams and other major water-source developments that have changed the limnological profile of the world," notes Dr Jackie King of the Freshwater Research Unit at the University of Cape

Town. "Most of the developed world now benefits in some way from the irrigated agriculture, hydropower generation, assured water supply, flood control, improved navigation and more brought about by these developments, and developing countries are increasingly seeking and achieving the same benefits."

Dr King was speaking at the 2009 International Conference on the Implementation of Environmental Water Allocations (IEWA) held in Port Elizabeth in February. More than 400 delegates gathered from all over the world to share experiences, exchange ideas and make recommendations regarding the reservation of water

of adequate quality and quantity for the environment. "These infrastructure developments have not been without costs in terms of declining ecosystem services," Dr King said. "These are services upon which all humanity depends."

Countries now face a major challenge of how to support national development goals, meet food needs, safeguard the livelihoods of rural people and simultaneously protect the world's increasingly degraded aquatic ecosystems. Over the last decade or so, environmental water needs have become increasingly recognised in water sector reform and water policy reform processes globally.

According to Dr Rafik Hirji, Senior Water Resources Specialist at the World Bank, there are some important aspects included in environmental flow provisions in these policies. These are, among others, legal recognition of environmental flows (giving the environment equal standing with consumptive water uses); clear recognition of the links between environmental flows and the ecosystem services provided by the flows; and recognition of all relevant parts of the water cycle when establishing environmental flow provisions.

POLICIES ARE NOT ENOUGH

However, as Dr Tom le Quesne of the WWF in the UK pointed out at IEWA, simply having these policies is not enough to ensure aquatic environments get the water needed to be sustainable. He cited the example of Mexico where a specific definition of environmental flows was included in the 2004 reform of the country’s National Water Law. “This definition improves the recognition of environmental flows within the law. Unfortunately, it has promoted the concept of the environment as a water user that, under the present framework, is challenging other water users for available water.”

In addition, poor information and lack of enforcement by the water authorities, coupled with other factors such as the low cost of water and energy subsidies for the agricultural sector to pump water, is resulting in a growing tendency to over-abstract water in Mexico. It has been estimated that groundwater is depleted at a rate of 6 km³ a year, while the number of overexploited aquifers has increased from 20 to 104 in the last 36 years, reported Dr Le Quesne.

In 1991, a water accord was signed to allocate the waters from the Indus River between the provinces of Pakistan. In addition, the Indus Water Accord recognised the need for a certain volume of water to be allowed to flow into the Indus delta, deferring to later studies the final determination of necessary flow volume. A steady increase in exploitation of the water resources of the river has

“Existing water users are understandably reluctant to give up their existing water use and strong action will be required in many cases to achieve implementation.”

resulted in reduced water to the delta area resulting in severe saline intrusion. Unfortunately, ten years of squabbling passed over the terms of reference before three studies were finally commissioned. These studies have not been released to the public, however.

“Due to the non-transparent and contested mechanism by which the flow studies were undertaken, the conclusions remain to be accepted by any stakeholders,” Dr Le Quesne pointed out. “Moreover, the prospects for implementation remain weak. Water allocation on the Indus within Pakistan is largely dominated by the dispute between the two principle riparian provinces, Punjab and the Sindh.”

ENVIRONMENTAL FLOWS IN SOUTH AFRICA

Water reform in South Africa was initiated as part of the suit of major reform

processes initiated following the country’s democratisation in the 1990s. In 1998, the National Water Act (NWA) was passed, widely considered one of the most progressive and holistic pieces of legislation regarding water resource management.

Sustainable use of all water resources was established as one of the primary objectives of the Act. The NWA requires that an Ecological Reserve be set aside for all water resources. This Ecological Reserve basically entails retaining a portion of the flow that would occur naturally in a resource (such as a river or stream) to maintain the ecological functioning of the resource in a state agreed to by people making use of that resource (be it for agricultural, domestic, or industrial purposes).

Existing policy requires that the Reserve has to be determined before any water use license may be issued. Stephen Mallory from Water for Africa explained that ecological water requirements are not easy to determine since they depend not only on the large number of natural components present in nature and forming an integral part of the ecology, but also the wide range of hydrological conditions experienced (especially in South Africa rivers) from zero flow to extreme floods.



SA Tourism

According to South African water law the environment has a right to water of suitable quality and quantity.

16 Environmental water allocation

South Africa has been a major centre for the development of methodologies for the assessment of environmental flows, and Reserve determination has been diligently pursued by the Department of Water Affairs & Forestry (DWAF).

Unfortunately, as in other countries full implementation, including operationalising the flow requirements, and monitoring to see if objectives are met, has taken place in few instances in South Africa. For example, the Olifants River, one of the major rivers flowing into the Kruger National Park, has ceased flowing on two occasions in the last three years despite a Reserve determination having been undertaken in 2001.

There are also good examples emanating from South Africa. The Berg Water Project outside Franschhoek in the Western Cape is the first project of its kind in South Africa to incorporate structures that permit the release of both high and

low flows to meet the Berg River's environmental water requirements.

WILL IT STAND UP IN COURT?

One of the reasons for lack of implementation of the Reserve (not only in South Africa) is that in many cases there is insufficient water available in the resource to meet both the Reserve and existing water use. "Existing water users are understandably reluctant to give up their existing water use and strong action will be required in many cases to achieve implementation," Mallory pointed out.

The South African NWA allows for a process known as compulsory licensing whereby all water use licenses are revoked and reissued, with allowance for the Reserve. However, compulsory licensing has yet to be implemented in this country. "It can be expected to be a difficult and drawn-out process since legal challenges in the face of severe

economic prejudice to existing water users is highly likely," said Mallory.

It is also said that, in many cases, authorities fear that the results of environmental water requirement determinations are not legally defensible. "There are concerns that water users would challenge the provisions for the Environmental Reserve if it was seen to impact on their supplies and that the scientific basis for the Reserve would not stand up to legal scrutiny," reported Prof Denis Hughes of the Institute for Water Research at Rhodes University.

In many cases, institutional capacity to implement reforms has proved to be a major challenge across a range of issues, including the assessment of environmental reserves, the understanding of hydrological data, and the implementation and enforcement of any policy. In South Africa, while environmental flows are set at a national level, it is catchment management



South Africa's National Water Act is seen as one of the most progressive pieces of legislation in the world, but implementation has proved challenging.

agencies and water user associations that would give effect to implementing these flows. Staff for monitoring are scarce, and capacity is increasingly stretched. Compliance and enforcement staff are critical, yet very poorly resourced at present.

Another challenge concerns the type of resource that water needs to be allocated for. For example, most of the existing methods to determine environmental flow have been developed with rivers in mind. But what about groundwater?

“Behaviour of groundwater is different to those of surface water bodies, for example, rivers can respond within minutes to rainfall events, while the response of groundwater is generally much slower – rainfall could take weeks or months to reach the water table,” reported specialist groundwater consultant Roger Parsons. “Groundwater is more diffuse in character than surface water, and geohydrological processes in one part of a catchment may have little if any bearing on the geohydrology in another part of the same catchment.”

This makes groundwater quality aspects difficult to address. Parsons recommended that, instead of trying to quantify the role of groundwater in terms of the volume of groundwater discharged to surface water bodies or the amount of groundwater that can be abstracted, it might be more prudent to get a better appreciation of the role that groundwater plays in sustaining a surface water body, and then ensure that this role is not compromised. “Defining setback distances for abstraction and monitoring aquifer response to such management measures could achieve this,” he said.

The challenges are similar for estuaries, distinct and valuable environments in which the continual mixing of freshwater and salt water generates a complex array of ecosystems. Environmental flow determinations are important to support the intrinsic, ecological, social and



Lani van Vuuren

In many catchments, such as the Nkomati, water resources are already over-allocated to other users, leaving little room for applying the Environmental Reserve.


economic values of these water bodies. Yet, in most countries the environmental flow requirements of estuaries have only received recent attention, reported Prof Janine Adams of the Integrated Environmental and Coastal Management Unit at the Nelson Mandela Metropolitan University.

“In most countries it was incorrectly assumed that the minimum flows determined for rivers would protect downstream processes, while in others the omission was as a result of the sectoral

management of water resources,” Prof Adams explained. Four main countries have developed environmental flow assessment methods for estuaries, namely Australia, South Africa, the UK and USA. These methods have mostly developed from practical applications, a ‘learning by doing’ approach.

INTO THE FUTURE

Current pressures on our aquatic ecosystems are enormous, and there is no doubt that there will have to be trade-offs to balance socio-economic development with environmental protection. A pertinent question is how to achieve this balance so that we ensure maximum conservation benefit at the lowest possible social and economic cost?

A clear message emanating from the IEWA conference is that the world is standing at a crossroads, and now is the time for important decisions to be made. “Many more dams will be built, especially in developing regions, and there is opportunity to learn from the past, and to help ensure that developments would not result, as has happened too often in the past, in more being lost than is gained,” concluded Dr King. 

WHAT IS ENVIRONMENTAL FLOW?

Environmental flow refers to the water regime of a river, wetland or coastal zone necessary to maintain the biophysical components, ecological processes and health of aquatic ecosystems and associated ecological goods and services. *Source: Prof Janine Adams, Integrated Environmental and Coastal Management Unit at the Nelson Mandela Metropolitan University*



The lower Mfolozi floodplain. This is what much of the area would have looked like before being drained and cultivated for sugar.

Ricky Taylor

Intensive Operation on Cards to Save SA's Top Estuary

Ill-informed decisions of the past coupled with the worst drought experienced in recent history is threatening to choke the life from Lake St Lucia on the KwaZulu-Natal coast. Now internationally-funded investigations are underway to ensure the longevity of one the of world's most important estuaries. Lani van Vuuren reports.

Initially proclaimed as a game reserve in 1895, Lake St Lucia is arguably the oldest formally protected estuary in the world. The lake has a surface area of about 35 00 ha, making it one of the largest estuarine water bodies in Africa. St Lucia's international importance is gleaned from the fact that it has been declared both a Ramsar Wetland of International Importance and a World Heritage Site.

Significant numbers of bird and animal species call St Lucia home. More than a hundred invertebrate and fish species have been recorded in the system. It is especially this function as an estuarine nursery area for marine fishes which makes St Lucia most valuable. This service is estimated to be worth more than R600-million per annum to South Africa (when the system is functional). In addition it is a recognised breeding ground for about 20 aquatic bird species. There are also large animal species roaming the estuarine system, including large numbers of hippos and crocodiles. Some endangered species found in the area include the red duiker, Samango monkey, black rhino, serval cat and suni antelope.

HISTORICAL CONNECTION

Despite its elevated conservation status, as well as acting as a major destination for national and international tourists, St Lucia has been subject to a series of freshwater supply constraints over many decades that now threaten its rich biodiversity.

Water enters the lake from five rivers, contributing an estimated mean annual total of 295 million m³. The Mkhuze River, which enters the lake at its northern extremity, contributes 56% of the annual river flow. However, historically, the Mfolozi River, which has an annual runoff much larger than the sum of all the other rivers entering the system, also used to connect intermittently with St Lucia. This water was especially critical during drier periods.

“Crocodiles, dying from dehydration and lack of food, had to be airlifted by helicopter away from the worst-affected areas.”

“The Mfolozi and St Lucia used to combine in a common bay (St Lucia Bay), explains Dr Ricky Taylor, Ezemvelo KZN Wildlife's Regional Ecologist for St Lucia. “During wet periods when there was a surplus of freshwater entering St Lucia from its rivers most of the Mfolozi water would have gone out to sea. However, at the onset of droughts, the joint Mfolozi-St Lucia mouth would close. The Mfolozi was then naturally diverted into St Lucia.”

During these conditions drought flows in the Mfolozi replaced much for the water lost by evaporation from the large surface area of St Lucia, alleviating drought stresses. For the duration of the drought there would have been no connection of St Lucia to the sea. At the end of the drought, the water levels would rise in the whole system and back up into the swamps.

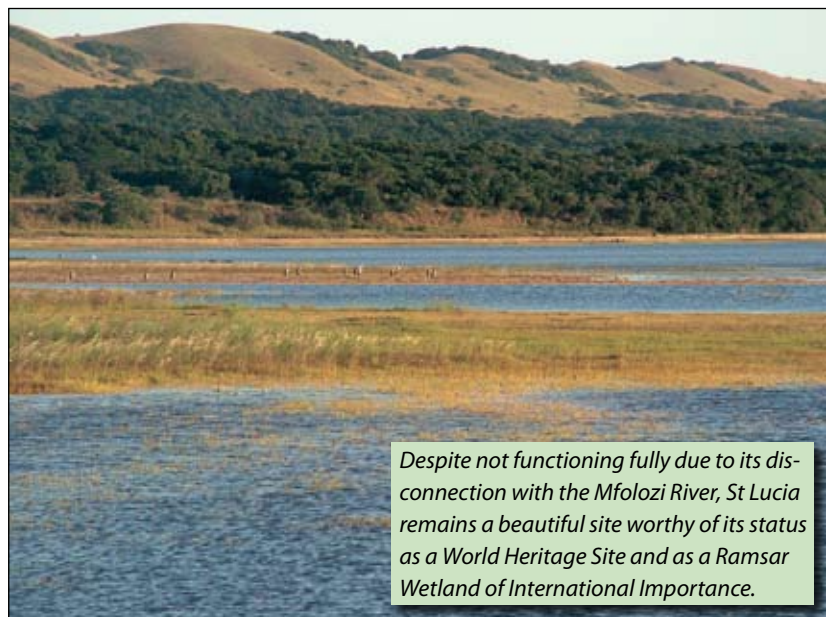
When high enough, the water overtopped the beach berm that had

formed. As the beach berm would have formed to a height of about 3 m to 3,5 m above mean sea level, the water in St Lucia backed up to this level before overtopping occurred. When it overtopped, it breached the berm, and a huge amount of water escaped, eroding away accumulated sediments, and rejuvenating the bay, explains Dr Taylor.

CHOKING THE ESTUARY

According to Prof Alan Whitfield of the South African Institute for Aquatic Biodiversity constraints to the functioning of the St Lucia ecosystem began in 1914 with the commencement of draining and canalisation of the Mfolozi Swamps to open up the swamp and river floodplain for sugar cane cultivation. The main canal, known as Warner's Drain, was completed in 1936 and the sediment filtering capabilities of the swamps in the Mfolozi River floodplain was effectively removed.

Prior to this the Mfolozi swamps acted as a huge filter – catching sediment and allowing only relatively sediment-free water to pass through. It was this sediment-free water that entered St Lucia during drought periods. As a result of these constructed canals, exceptionally high sediment loads from the Mfolozi River started entering the St Lucia system directly.



Despite not functioning fully due to its disconnection with the Mfolozi River, St Lucia remains a beautiful site worthy of its status as a World Heritage Site and as a Ramsar Wetland of International Importance.

Ricky Taylor

Dr Taylor says that by the 1940s, serious concerns were expressed about the rate of sedimentation in the combined St Lucia-Mfolozi mouth. "Then, in 1950, the whole mouth area choked up, completely blocking both systems from the sea. To save farms from being flooded by the backing-up Mfolozi water, a canal was dredged through to the sea to 'release pressure'. This became the new Mfolozi mouth." This action deprived St Lucia of its single largest freshwater supply.

It took five years to dredge enough of the sediment away to be able to open the St Lucia mouth (and another eight years to remove all the accumulated sediment). Between the 1960s and 1990s authorities adopted an 'open mouth policy' rather than allowing the St Lucia mouth to close naturally as it usually does during drought periods.

At the same time, an attempt was made to stabilise the St Lucia mouth by building hard structures. "This was a failure as it did not achieve the desired condi-

tion of having a self-scouring mouth," notes Dr Taylor. In addition, it resulted in significant build-up of salinity within the system as sea water entered to replace water lost through evaporation.

PROLONGED DEGRADATION

In the last 50 to 60 years increased human pressures on the remaining rivers entering Lake St Lucia (Mkhuze, Mzinene, Nyalazi and Mpati) have further reduced the runoff of rivers entering the system by about 20%. This is mainly due to irrigation abstractions, forestry plantations and evaporation from farm dams.

The estuary has also been affected by a series of droughts, which occur every ten years or so. A particularly severe drought occurred from 1967 to 1972. All the rivers entering St Lucia stopped flowing for most of this period. And due to the artificial situation in which the mouth was kept open, significant volumes of seawater entered the system. It also brought with it some 20 million tons of salt over the duration of the drought.

St Lucia is renowned for its pelican colony.



"This proved to be a lethal combination for the shoreline vegetation of St Lucia," notes Dr Taylor. "Large mammals such as hippos had difficulty in finding drinking water and the crocodiles, dying from dehydration and lack of food, had to be airlifted by helicopter away from the worst-affected areas."

In an effort to alleviate the condition, a canal was excavated in the Mkhuze Swamps to the north of the St Lucia estuary. "This was a panic reaction that has since then cost the taxpayer many millions of Rands to repair – and money is still being spent on it," says Dr Taylor.

TURNING THE TIDE

St Lucia is again experiencing a prolonged and severe drought which has lasted for eight years. With the knowledge gained from the previous droughts, the mouth was allowed to close naturally in 2002. For years no water from the Mkhuze River flowed into St Lucia (good rains at the start of this year, however, brought some



The low-lying sugar cane fields in the Mfolozi swamp have to have a network of drainage canals to remove water.

Ricky Taylor



SA Tourism

much-needed relief). "This drought has been as bad or even worse than the drought of 1967-72," maintains Dr Taylor.

Large-scale evaporation has caused significant water to be lost from the system (the effect was worst in 2006, when only 10% of the lake was left). Then the system divided into several compartments that were separated from each other. There have been some die-offs of fish, and the remainder concentrated in the smaller volumes of water. Since the mouth has closed, there has been little breeding of fish. Coastal storms in March 2007 resulted in very high seas which breached the sand bar at the estuary mouth and caused salt water to pour into the lake thus worsening salinity levels. At one stage authorities feared that the water would become hypersaline – such water is likely to kill all the protective vegetation along the lake margins.

In this degraded state this world-class estuary cannot function at its full

potential. "Lake St Lucia is like a patient in intensive care. Critical decisions have to be taken now. The only long-term solution is finding a sustainable way of re-linking the life-artery of Mfolozi with the estuary," says Prof Whitfield.

"Lake St Lucia is like a patient in intensive care. Critical decisions have to be taken now. The only long-term solution is finding a sustainable way of re-linking the life-artery of Mfolozi with the estuary."

In an experimental initiative during the winter months of 2008, the Mfolozi estuary mouth was closed and a channel, constructed in the 1960s, linking the Mfolozi to the St Lucia system was opened up, thus allowing relatively sediment-free river water to flow into the St Lucia estuary. In the absence of the river flooding (and associated high sediment loads) the Mfolozi link was retained for six months, resulting in about 15 million m³ of water entering St Lucia. When the river came down in flood during the start of the rainy season, it breached to the sea, rendering the link ineffective.

"Although this pattern of manipulating the Mfolozi estuary mouth during winter can be repeated in the future it is not a solution to the St Lucia salinity



A jetty, high out of the water, indicates how much the water has dropped below normal levels.

Ricky Taylor



The mangrove-lined channel used to carry Mfolozi water into St Lucia in an effort to simulate the connection that linked the two systems to each other prior to the establishment of sugar.

that the future effects of global climate change could see these fields becoming un-farmable with a rise in sea level.

“If we could restore those low-lying swamp areas this would enable the Mfolozi to be linked permanently to St Lucia. This would ensure that the vital freshwater supplies necessary to prevent extreme hypersalinity and widespread desiccation within the lake would be delivered, as well as to assist with providing the necessary water volume to flush out the estuary when the mouth opens at the end of a closed phase,” says Prof Whitfield.

St Lucia is a resilient ecosystem, and if good freshwater flows can be restored to the system it can return to its full potential. Within the estuary there are a variety of habitats that will the maintaining founder stocks of plants and animals that will colonise the system once water levels are restored.

Ricky Taylor


problem, primarily because of the relatively small freshwater volumes delivered to the area during this low flow season,” explains Prof Whitfield. “We must find a way of re-linking the Mfolozi River to St Lucia permanently.”

At present, longer-term options are being investigated with funding from the Global Environment Facility of the World Bank. Studies are underway to investigate several restoration options. The ideal solution would be to re-establish parts of the Mfolozi area as swamp to filter out the river-borne sediment and then re-establish the connection to allow the Mfolozi to enter St Lucia.

However, there is bound to be much resistance for such a decision from stakeholders on the Mfolozi floodplain. Because of the rich soils and high moisture content the sugar cane fields on the Mfolozi floodplain are among the most productive sugar farms in South Africa. The land is also among the most expensive in the country.

An easier option might be to buy back

and rehabilitate some of the low-lying lands of the Mfolozi floodplain that was previously swamp, and is currently under sugar cane production. These low-lying fields are prone to flooding and require extensive canalisation and levees to protect them. Experts predict

Even in its degraded state Lake St Lucia remains one of the top estuaries in South Africa. However, the recent drought has shown very clearly that this resilient system cannot survive if the Mfolozi River remains permanently separated from this World Heritage Site. 



When the Mfolozi comes down in spate, it carries huge loads of sediment. It is because of this sediment load that the Mfolozi was separated from St Lucia in 1950.

Ricky Taylor



Development Steeped in Controversy

The necessity of the Pongolapoort Dam, one of the largest dams in South Africa, has been debated for decades after its construction. Lani van Vuuren takes a look at the development of this dam.

The Pongola River rises at some 2 200 m above mean sea level near Wakkerstroom, Mpumalanga, and descends steeply through the major portion of its catchment to the west of the Lebombo mountains. The Pongola passes between the Lebombo and Ubombo ranges through a narrow gorge (known as Pongolapoort) and the lower reaches of the river lie on the Maputuland coastal plain east of the mountains in northern KwaZulu-Natal.

Here, the river has a slope of 1 in 3 000; the abrupt change in gradient stems the flowrate of the river on the plain, causing a deposition of part of the sediment load and the flooding of extensive areas adjacent to the river course. This broad alluvial plain, known as the Pongola floodplain, extends from the

gorge to the confluence of the Pongola and the Usutu rivers, close to the border with Mozambique.

SOUTH AFRICAN HERITAGE

The Pongola floodplain is one of the most biologically diverse ecosystems in South Africa. The complex of lagoons, oxbow lakes, marshes, forests, levees and floodplain grassland provide habitat for a very wide variety of birds, fish and animals. Importantly, the area is home to thousands of people from the ama-Thonga culture, who have lived adjacent to the floodplain and subsisted off the resources it provided for hundreds of years. Prior to construction of the dam, summer flooding inundated the floodplain creating a diverse set of environmental



Pongolapoort Dam is a medium thin, double curvature arch dam with a gradual transition towards a gravity thrust block on the left flank.

conditions and when these floodwaters receded, rich soils were exposed. These soils were cultivated as they dried, providing a wide range of crops to local inhabitants. In addition to cropping, the natural resources of the forests adjoining the floodplain provided a variety of products for food, fuel, construction and traditional medicines. In winter, the floodplain provided grazing for livestock.

But it was the agriculture potential of the adjacent Makatini flats rather than the value of the floodplain ecosystem services that drew the attention of the National Party government. Long before the decision was uttered to build the Pongolapoort Dam in 1960, the area to the east of the gorge was

PONGOLAPOORT DAM – QUICK FACTS

Type of dam: Double-curvature single-arch

Height above lowest foundation: 89 m

Length of crest: 515 m

Gross capacity: 2 500 m³

Volume content of dam: 575 000 m³



earmarked for white farmer upliftment, particularly through sugar cane production.

IRRIGATION FARMING

In the Depression years of the 1930s, a government irrigation settlement was established upstream of the dam, on the west side of the Lebombo mountain. This settlement comprised 159 plots with a total area of 6 189 ha. A sugar mill was constructed in 1954. Water for irrigation was provided either by government-built gravity canals or direct pumping from the river. (This settlement, which is today the town of Pongola, is still strong today)

By 1955, plans were well advanced for the construction of a dam in the Pongolapoort. The dam was to be big enough to support 40 000 to 50 000 ha of irrigation on the Makatini Flats, a highly fertile area adjacent to the floodplain on both sides of the river. Apart from boosting commercial farming, the government also hoped to 'stabilise the frontier' bordering Mozambique and Swaziland. At the time, it was believed that development would automatically follow impoundment and so not much consideration was given to alternative development options.

Interestingly, merits of the scheme were a subject of debate even after construction started. One of the main grounds of criticism was that intensive soil and other tests, which would determine suitable land usage, were only undertaken after the project was given the go ahead.

After the scheme was announced it took three more years of preliminary work before construction of the actual dam started in 1963. Four suitable sites were investigated. Siting was complicated by the underlying geological conditions. The dam is founded mainly on good-quality dacite of the Lebombo Group, but the presence of deeply weathered breccia dykes crossing the river at almost right angles strongly influenced the founding conditions.

In order to avoid crossing the two largest breccia dykes, the dam had to be sited so far downstream that the upper flanks could not make optimum use of the site topography. The dam was eventually located at the eastern end of Pongolapoort.

A DAM IN THE MIDDLE OF NOWHERE

Prior to the construction of Pongolapoort Dam, the area was fairly isolated. There were no communications or services of any sort and, according to media reports at the time, resident engineer Mr RF Phélines spent the early years of construction sleeping in a tent.

Before building of the dam itself could start, a heavy-duty road was constructed over the Lebombo mountains to the

railhead around 30 km away. A village was also erected to house staff, with a compound for the estimated 900 black workers employed on the project.

Until work started on the Gariep Dam in 1966, Pongolapoort was the largest dam under construction in South Africa. It is a medium thin, double curvature arch dam with a gradual transition towards a gravity thrust block on the left flank. It has a maximum height of 89 m and a crest length of 515 m. The dam has a controlled and an uncontrolled spillway. The gross capacity of the reservoir is 2 500 million m³, which is more than twice the mean annual runoff. The chute spillways have a combined capacity of 2 010 m³ at high flood level. The thickness of the wall above the cushion is 18,3 m tapering to 8,2 m at the spillway and then flowing to 11 m to carry a road across it.

The foundations and abutments of the dam presented a number of challenges. During excavation for the foundation, great difficulty was experienced as a result of the sensitivity of the brittle dacite to blasting and stress relief and its reaction to changes in temperature. In the South African National Committee on Large Dams' publication *Large Dams and Water Systems in South Africa* it is written: "Whole layers of what appeared to be sound rock scaled off with a noise like a pistol shot and necessitated the use of 30 m-long rock anchors, line drilling and the use of hydraulic wedging for final excavations."

Work on the dam was on a 24-hour basis, requiring up to 764 m³ of concrete a day. The aggregate came from a site 20 km upstream; some two million tons had been stockpiled at the start of the project.

Another significant challenge was the high average air temperatures on the site. This was overcome by pre-cooling the aggregate with controlled amounts of crushed ice. Pongolapoort Dam was the first dam in South Africa where this artificial cooling method was used. At a later stage, piped cooling systems, which gave better control, were used in the construction of the Gariep and Vanderkloof dams.

The dam went up in 1,8 m sections, the curvature of each one having to be separately calculated, taking about 30 hours on a manual calculation. Each vertical section is independent of the other. The gravity sections on the flanks induced blasting of some 500 000 t of rock. The dam was eventually completed in 1973.

It has to be noted that the envisaged large-scale irrigation development never occurred following the completion of the dam. This was due to, among others, a significant drop in the price of sugar. Today, only about 3 000 ha of irrigation has been created.

Right: Fish was an important source of food for people of the floodplain. Traditionally fish were caught using weaved baskets known as isifonyo.

MAINTAINING THE FLOODPLAIN

The building of the dam and planned irrigation developments of the area focused attention on the unique floodplain ecosystem downstream of the scheme and the plight of the AmaThonga people dependent on the ecosystem services it provided. The completion of the dam resulted in the flow of the river to the floodplain being regulated. Strong voices were heard from the research community for releases from the dam to stimulate the natural flow regime and thus maintain the floodplain integrity.

A multidisciplinary research programme was initiated by Prof Charles Breen and Jan Heeg of the University of Natal in the 1970s with the aim to understand the floodplain as a social-ecological system. "Even today we would consider this an unparalleled exercise in environmental flow determination because it had the express objective to deliver both social and environmental justice," explains Prof Kevin Rogers, Director of the Centre for Water in the Environment at the University of the Witwatersrand.



"The research was the first in this country, and arguably internationally, to propose flow releases from a dam to maintain ecosystem services delivery to people, and as such was an important precursor to our current concept of the Ecological Reserve, which has the same purpose," Prof Rogers explains.

"The government of the time was sympathetic to a concept of 'water for ecosystem maintenance' but needed much convincing that the Pongola floodplain should take preference over agricultural development."

An ingenious cost/benefit analysis by Breen and Heeg, however, clearly demonstrated that using 14,6% of mean assured yield to inundate the floodplain should generate the required ecosystem services which would be of much greater economic and social benefit than if that water were used to grow sugar cane under irrigation. The government was convinced and preparations then began to implement flow management in the 1980s.

However, in the early years following its completion Pongolapoort Dam could not be filled as it would inundate part of Swaziland. While negotiations with Great Britain prior to the independence of Swaziland had solved the problem of inundation, these decisions were withdrawn by Swazi authorities following the country's independence.

During this time floodwater had to be discharged through the scour outlets. These outlets were not designed for that purpose, however, and were subsequently damaged. These damages necessitated the replacement of the sleeve valves which, in turn, reduced the capacity of the scour outlets by 36%.

Both the political and engineering problems were overcome by 1982. This was none too soon because in 1984 the area was hit by tropical cyclone Domoina. A 1985 Department of Water Affairs report on the effects of the cyclone describes that in January when Domoina hit, the catchment of the dam received more than 700 mm of rainfall (a record to this day). A peak inflow of 1 600 m³/s occurred into the Pongolapoort Dam on 31 January 1984. This peak was 18 times higher than the previous highest recorded peak. At the time the dam was only 13% full. The total inflow as a result of the cyclone was 2 000 million m³ or 87% of the total capacity of the dam.

FLOODING TOO EARLY OR TOO LATE

During the 1970s social, ecological and hydrological scientists funded by the Cooperative Scientific Programmes gained a detailed understanding of the Pongola social-ecological system. It was clear that unless water was delivered to the

floodplain at particular times of the year, for particular durations and to achieve a certain level of flooding, water quality would decline, organisms would not complete their lifecycles and people's livelihoods would be in jeopardy as ecological service provision was disrupted.



Pongolapoort Dam as seen from the air.

The scientists proposed a flow regime that should maintain the integrity of the ecosystem, and ecological services to the people, yet have minimal effect on irrigation potential. Winter flows in the Pongola River were set to be around 2 m³/s to meet the requirements of local people but also those stipulated by Mozambique.

Periodic increases in flows (about 80 m³/s) in early summer (November to January) would replenish the water in most floodplain pans, and a large flow (600 to 800 m³/s) sometime in February would inundate the floodplain to high flood level. The early summer flows were planned to flush out saline water and refresh water available to people and livestock at the end of the dry winter. The February flow would provide the cue for fish migration and breeding, and the plant growth that followed the receding water provided grazing during the winter months when grazing off the floodplain was limited.

WATER FOR PLANTS OR FOR PEOPLE?

Relative to the detailed flow regimes of current day Ecological Reserve that for the Pongolo was simple, yet more than 25 years later none of its components, let alone the regime, have been implemented. While many issues have clouded decision making over this time, one of the main problems has been confusion between whether flow releases from the dam should be for the delivery of ecological services or agriculture on the floodplain, notes Prof Rogers.

Once the research process had delivered the proposed flow regime funding dried up and the hydrological and ecological researchers moved on to other projects. During the final years of the programme, however, social scientists had suggested that traditional farmers switch from their usual multi-coloured maize to white maize, which had the potential to give a higher yield.

Within a few years white maize became the main crop, but since it had a much longer growing period that the traditional variety, fields were sometimes destroyed by floods that arrived before the grain was mature. Farmers, with the assistance of ex-social researchers, therefore persuaded dam operators that the proposed between-flood periods should be extended to allow the maize to mature.



The traditional multicoloured cob cultivated on the floodplain.

Kevin Rogers

This began an unstructured process of so-called 'negotiated' releases that has essentially ignored the regime proposed by the original research team and its purpose of generating ecosystem services. Between 1984 and 2005 some 25 releases were made from the dam. In some years there were no releases, in others two or three, and they came at any time of the year.

"Consequences of this unstructured decision making in a policy vacuum were soon felt throughout the social and ecological system," notes Prof Rogers. "Fish stocks declined rapidly as adults were not ready to spawn in the cold of July or water levels fell too fast for juveniles to establish in the population. When floods were far apart evapo-transpiration losses of water resulted in many of the channels and oxbow lakes of the floodplain drying up, killing many aquatic organisms."

Traditionally, people had not fenced their fields on the floodplain because these water bodies prevented cattle from accessing them during the growing season. Now that they were drying up the cattle had easy access to the diverse crop lands that had fed the people for centuries. "Serious conflict was reported between the agriculturists, graziers and fishermen within a community that no longer had the surety of food supply they had been used to under the natural flow regimes."


LOOKING TO THE FUTURE

Almost 40 years after the construction of the Pongolapoort Dam, management of its waters is still the subject of contention. What future does this seemingly large white elephant hold under South Africa's new legislation?

Government authorities have not written off the Pongolapoort Dam. Utilisation plans have been drawn up for the dam, focusing on its potential as an eco-tourism draw card and its potential as a water resource for domestic water supply in the area. The area around the dam certainly has a high conservation value, and today much of it is protected, either as a public nature reserve, private game farm of communal protected area. It is said that the dam could play a particularly important

role in the Lebombo Spatial Initiative, an ambitious project that involves the regional interests of South Africa, Swaziland and Mozambique.

However, the fate of the downstream floodplain ecosystem remains unresolved despite its unique place in the history of water resource management in South Africa. "This country is hailed for its innovative water policy based on an Ecological Reserve to ensure delivery of ecosystem services to society. The origins of the Pongola floodplain and Pongolapoort sagas preceded this law, but the social conflicts and confusion about the purpose of managed flows persist more than ten years after its promulgation," notes Prof Rogers.

Will the spirit and letter of the National Water Act prove strong enough to restore the ecological services of the Pongola floodplain upon which so many poor people depend? 

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Thanks to Kevin Rogers and eWISA for photographs

A photograph of a rusty metal structure, possibly a bridge or pier, extending over a body of water. A single drop of water is falling from the edge of the structure, creating a series of concentric ripples on the water's surface. The background is a blurred view of the water and distant structures.

New Water Framework Counts Every D

R O P

Large-scale bulk water infrastructure projects are said to become scarcer in future as the government seeks alternative ways to ensure South Africa's water security. Lani van Vuuren reports.

At the recent launch of the Water for Growth & Development framework in Midrand the message was clear: South Africa needs to implement drastic measures in order to secure its water future. The framework, the result of two years of consultation of the Department of Water Affairs & Forestry (DWAF) with key players in the water sector, will guide actions and decision that will ensure water security in terms of quantity and quality to support South Africa's requirements for economic growth and social development.

"The increasing pressure to deal with increasing economic and social demands, in a declining world economy presents particular challenges to the water sector," noted Minister of Water Affairs & Forestry Lindiwe Hendricks. "It certainly presents pressure on our natural resource base and our environment. We need to ensure that the little water we have is protected from pollution and conserved to achieve efficient use. This requires careful management of this precious resource so that we are able to extend basic water services to every citizen while meeting the needs of economic growth without threatening the environmental integrity of our water resources."

FUTURE WATER MIX

Addressing hundreds of delegates at the launch of the framework, the minister said that her department would have to make "some very difficult and bold" decisions in the way it harnessed and allocated available resources which would have to be very different to the way in which it was done in the past. "The process of developing the framework has forced both government and the water sector partners to confront some hard truths about challenges in the sector," said Hendricks. One significant departure from the norm would be the sourcing of water to meet increased future demand.

Historically, investment by DWAF in securing water supplies mainly took the form of dams, reservoirs and accompanying infrastructure. However, most of

the best dam sites have been developed, and there is currently very little potential in this regard apart from some parts in KwaZulu-Natal and the Eastern Cape. The large-scale bulk infrastructure projects are also extremely expensive to build.

In future, apart from traditional augmentation schemes, the department will increasingly investigate alternative water supply options to meet increasing demand. "In the long term, while surface water will remain the predominant source of water, DWAF expects surface water to contribute proportionately less with proportionately significant increases in other options, including recycling of water, desalination and increased use of groundwater," said DWAF Director-General Pam Yako. "Large-scale bulk water transfer projects will only be implemented in cases where it is really necessary."

Dedicated research and the development of improved technology are making alternative water resources cheaper and easier to implement. For example, advances in desalination technology have reduced costs to between R5/m³ and R7/m³, making it a more attractive option, especially in coastal areas. DWAF is seriously considering the desalination of seawater for coastal towns in future. Large cities such as Cape Town and Durban are already investigating the feasibility of this technology to augment their water supplies.

The department is also looking at increasing supply from groundwater sources. While groundwater is widely accessible and often close to point of use, planners and consumers frequently either do not recognise it as a resource or shun it as inferior to surface water. However, DWAF believes that groundwater offers a relatively conflict-free way of providing water to especially rural communities across the country. The department is set to invest in quantifying as accurately as possible resource volumes at a scale useful to planners and users at local level in efforts to exploit this means of water supply more effectively.

Water recycling is a phenomenon that is expected to increase significantly especially in urban areas in years to come. The use of treated effluent has been identified as a major potential source of water, especially in coastal cities where most effluent is discharged into the sea at present. The treatment of water from mining sources is another attractive option as it could lower the environmental costs of this water, which tends to present a high pollution risk to both the country's rivers and the water table in areas with extensive mining activity.

CURBING DEMAND

Henceforth water conservation and water demand management would be non-negotiable in all water-dependent sectors, reported Yako. The department is currently engaging with each sector and will be setting sector-specific targets. "DWAF is very mindful of water use behaviour that impacts negatively on water resource quantity and quality. It is exploring a potential mix of mechanisms to change this behaviour that include regulatory instruments, market-based instruments, self regulation and awareness and education," said the Director-General.

Unaccounted-for water will also receive more attention.

A major source of water loss is ageing infrastructure exacerbated by poor operations and maintenance at municipal level. Analysis shows that this state of affairs is a multi-faceted problem, which includes a lack of managerial and technical skills as well as a lack of funding. DWAF expects to strengthen its



Lindiwe Hendricks

Minister of Water Affairs & Forestry Lindiwe Hendricks said her department would have to make some very difficult and bold decisions in the way available resources were harnessed and allocated to ensure water security for South Africa.

MAIN RECOMMENDATIONS FROM THE WATER FOR GROWTH & DEVELOPMENT FRAMEWORK

Strengthen institutional capacity: While potential water imbalances and interventions to be taken to avert water shortages have been identified, DWAF at present lacks the capacity to oversee the implementation of these strategies and other aspects of its mandate.

Mainstream water: Water must be placed at the heart of all planning decisions taking place in the country to ensure that any decisions that rely on the steady supply of water, both in quantitative and qualitative terms, adequately factor in water availability.

Diversify the water mix: In addition to conventional sources, such as surface water (which accounts for 77% of current water availability), other potential sources, such as desalination and re-use, ought to be considered given the high risk of water shortages.

Promote water conservation and water demand management: The establishment of the water demand funding facilitation unit must be prioritised to provide support to municipalities in their efforts to introduce water conservation/water demand management.

Promote and maintain water quality: DWAF needs to strengthen its compliance enforcement and monitoring as a way of clamping down on water use behaviours that have a detrimental impact on our water resources

Address service backlogs: Service backlogs must be prioritised and addressed through a combination of short-term interventions (such as rainwater harvesting) and the further enhancement of ground-water sources.

Change water use behaviour for the future: DWAF must explore a potential mix of mechanisms to change current negative behaviour, including regulatory instruments, market-based instruments, self-regulation and awareness and education.

Nurture attitudinal and behavioural changes towards the value of water: DWAF has invested significantly in water awareness campaigns over the years and must sustain these campaigns, especially targeting younger children of primary school age.

Source: Water for Growth & Development Framework

Long-term national view of the potential combination of main water sources

Water source	2008	Mid term (2025)	Long term (2040)
Surface water	77%	72%	65%
Groundwater	8%	9%	10%
Water recycling	15%	17%	22%
Desalination	<1%	2%	3%

Source: Water for Growth & Development Framework



Water conservation and water demand management were non-negotiable for all sectors, according to Department of Water Affairs & Forestry Director-General Pam Yako.

regulatory efforts to support local authorities in a bid to reverse this situation. "It becomes an even more crucial intervention when the pollution of water resources is due to faulty (municipal) wastewater treatment works," noted Yako.


CENTRE OF ATTENTION

The Water for Growth & Development framework points to the relationship between water availability and the many forms of economic activity that depend on available water supply of specific levels of quality. DWAF's position is that the country's growth target cannot be achieved at the expense of the ecological sustainability of water resources or meeting people's needs.

"My department will continue to engage extensively and intensively with other sector departments and water sector users on the recommendations outlined in the framework," said Hendricks.

Rather than being an add-on or after-thought, DWAF sees the need for water to be mainstreamed and placed at the nucleus of all planning decisions both in the public and private sector.

The framework seeks to strike an appropriate balance between supply- and demand-driven approaches, taking into account the specific constraints pertaining to this resource. It seeks to ensure sustained investment in the water sector to avert any potential water crisis and to ensure that water management supports social and economic growth targets without compromising ecological sustainability of the resource.

The time for action is now. Shortages will become more prevalent if proper attention is not given to providing more water and managing demand. At the current rate of use the country is more likely to experience water shortages than surpluses by 2025. 



Dmitriev van Rensburg

The Department of Water Affairs & Forestry aims to strengthen its regulatory function to assist local authorities in curbing their water losses.

SAICE's Concrete Lady Takes the Helm

New president of the South African Institution of Civil Engineering (SAICE), Prof Elsabé Kearsley, has pleaded with members not to lose sight of the real beneficiaries of their professional efforts – the ordinary citizens dependent on the infrastructure they provide. Lani van Vuuren reports.

Delivering her inaugural address in February, Prof Kearsley, a specialist in the field of concrete materials and Head of the Department of Civil Engineering at the University of Pretoria, said that the civil engineering profession was essentially about saving lives and improving the quality of life of communities. This was a fact that engineering professionals should not lose sight of. "As civil engineers we should see it as our privilege to use the knowledge we acquired through tertiary education to serve society. We are the custodians of modern civilisation and it is our responsibility to look after and maintain society."

This also included ensuring investment in infrastructure remained a priority for government, noted Prof Kearsley. "Every decision-maker should be aware of the fact that clean water and sanitation, which is a fundamental requirement for healthy communities, can only be delivered as a result of the effort of civil engineering professionals. Likewise structural engineering makes it possible to erect safe, durable and strong shelters, and transportation engineering is required to move people and products."

According to Prof Kearsley, it was "impossible" for a modern civilisation to exist without civil engineering, and she berated civil engineers for not putting in more effort to convince society of the importance of employing engineering professionals to execute technical functions.

With regards to the future, Prof Kearsley expressed her grave concern over the

career guidance and subject choices offered to learners. Instead of encouraging learners to study much needed skills, for example, mathematics and science, many schools rather aimed to boost their pass rates by steering learners away from these perceived difficult subjects.

The new SAICE president was especially disconcerted over the fact that the Department of Education announced in 2008 that the third mathematics paper (covering geometry and trigonometry – skills one would need for an engineering education) was not compulsory for the final countrywide exam at the end of last year. Many schools did not even cover this work and pupils were instructed to find private tutoring if they wanted to write the paper. In the end, very few learners did.

Urgent intervention was required to prevent this situation from perpetuating, maintained Prof Kearsley. "We as engineering professionals are the only people who can speak up to ensure that our school system does not make it impossible to train the engineering professionals this country needs for the future," she said.

She added that more attention needed to be paid to research and development. Citing the examples of the development of the personal computer and the advances in telecommunications, especially since the advent of the cellular telephone, Prof Kearsley noted that years of

research were required between the initial development of the idea and the large-scale market acceptance of the concept.

At present, South Africa undertakes only about 0,5% of global research. "To date, the civil engineering community has been very slow at investing in research, and the time is ripe for the industry as a whole to develop a collective approach to support research and development."

South African engineers are highly rated internationally and many problems have been solved through the creativity of locally-trained experts. Local civil engineering professionals can make a difference. "As practitioners we need to promote our profession by ensuring that all decision-makers know exactly what the extent of the contribution of civil engineering is in any modern civilisation," said Prof Kearsley. "We have to engineer a better future, not only for ourselves, but for everybody in South Africa." 



Prof Kearsley receives her presidential chain from outgoing SAICE president Johan de Koker, with assistance from SAICE's Zina Girald.

How big are your ECOLOGICAL FEET?



We all have a role to play in minimising the degradation of our natural resources.

Your ecological footprint has nothing to do with the size of your shoes. It is actually a measure of a person's demand on Earth's natural resources, including water.

The size of your ecological footprint depends on how much biologically productive land and water you require to live your life. You can reduce this footprint by not wasting electricity and water, cycling or walking to places close by rather than driving, and eating locally-produced rather than imported food.

To calculate your ecological footprint, take the following quiz.

Water use

The amount of water used often depends on whether you have running water in your home, a tap in your yard, or whether you carry water from a river or dam. The way that you use water in your home can sometimes be very wasteful.

When you wash, do you use:

a	A bucket	b	A shower	c	A bath
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Your score: a) 0 points, b) 5 points, c) 20 points

Re-using water

South Africa is a water-scarce country. It is believed that if no immediate action is taken by the year 2025 we will have insufficient water for use in our homes, for agriculture and for industry. By using water carefully, you can help to conserve our water sources.

When you have finished washing at home:

a	Does your water run straight down the drain?	b	Do you use the water on your plants?
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Your score: a) 20 points, b) -10 point

Energy use

Whether you use electricity, coal or paraffin for energy in your home, you are polluting the air – which causes acid rain, global warming and health problems. You can conserve energy by using energy-saving devices (such as energy-saving light bulbs), and solar-powered energy systems.

In your home do you have at least one energy-saving method?

a	Yes	b	No
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Your score: a) -10 points, b) 20 points

Indigenous plants

By growing indigenous plants in your garden, you can contribute to biodiversity because you will attract indigenous insects, birds and other animals. Indigenous plants have many advantages over alien plants, for example, they require less water.

Excluding your home-grown fruit and vegetables, in your garden at home are:

a	Most of the plants indigenous	b	More than half of the plants indigenous	c	Less than half of the plants indigenous	d	None of the plants indigenous
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Your score: a) -10 points, b) 0 points, c) 10 points, d) 20 points

Animal-based products

Producing animal products (beef, chicken, pork, eggs, fish, dairy, etc) puts much more pressure on the environment than producing vegetables. Many people eat more meat than their bodies need. People who eat a lot of meat have more impact on the environment than those who eat less meat or no meat at all.

How often do you eat animal products?

a	Never	b	A few times a week	c	Once a day	d	Small amounts at every meal	e	A large part of every meal
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Your score: a) -10 points, b) 0 points, c) 5 points, d) 10 points, e) 20 points

Poisons in the garden

Poisons – more correctly known as biocides – are often used to kill rats, insects and weeds. Many of the ingredients in these biocides may cause allergies, trigger cancer growth and cause genetic defects. Frequently we don't actually need to kill in the first place! For example, the flat spider on the wall won't hurt you at all (and it helps ridding the home of other pests, such as flies). But if we really do need to kill, we need to decide upon which option of removal is the most environmentally friendly.

In your home, when you have a problem with household pests do you:

a	Use the strongest insecticide or other poison and use until the problem is solved	b	Buy specially-designed environmentally-friendly products	c	First attempt to solve the problem with a less destructive alternative
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Your score: a) 20 points, b) 0 points, c) -10 points



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Did you know that it takes about 2 400 litres of water (to grow the grain to feed the cow and to sustain the cow) to produce a 150 g hamburger patty?

Locally-grown food

Much of the energy cost of food production is spent transporting food from harvest to market, and for processing, packaging and storage. Growing food yourself or buying locally-grown, in-season, unprocessed food can therefore reduce energy consumption. Buying food from local farmers can greatly reduce your ecological footprint.

How much of the food that you eat is locally grown, unprocessed and in-season?

a	Most	b	About three-quarters	c	About half	d	About a quarter	e	Very little
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Your score: a) -10 points, b) 0 points, c) 5 points, d) 10 points, e) 20 points

Travel

Poisonous gases and substances released by cars and other motor vehicles include nitrogen oxides, hydrocarbons and lead which contribute to acid rain, smog, health problems and global warming.

How do you get to work/school/university?

a	On foot	b	Bicycle	c	By taxi/train/bus	d	By car
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Your score: a) -10 points, b) 0 points, c) 5 points, d) 20 points

Re-use

Re-use of some of your waste helps to reduce the impact on the environment; reduces the amount of waste that goes into landfill sites (rubbish dumps) and reduces the amount of raw materials required.

At home do you re-use waste materials such as plastic, paper, glass and tins:

a	Never	b	Sometimes	c	Often
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Your score: a) 20 points, b) 5 points, c) -10 points

Consumer choices

Some goods available in supermarkets pollute the environment more than others – a roll-on deodorant is better than a spray containing CFCs (which break down the ozone layer); a brightly coloured toilet cleaning liquid is not necessary as that colour doesn't clean the toilet.

When you shop do you choose the least polluting product?

a	Always	b	Often – depending on price, brand or what you have seen on television	c	Sometimes – depending on price, brand or what you have seen on television	d	Never think about such things
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Your score: a) -10 points, b) 0 points, c) 5 points, d) 20 points

Recycling

Recycling some of your waste helps to reduce the impact on the environment, reduces the amount of waste that goes into landfill sites (rubbish dumps), and reduces the amount of raw materials required.

At home do you recycle waste materials such as plastic, paper, glass and tins:

a	Never	b	Sometimes	c	Often
---	-------	---	-----------	---	-------

Your score: a) 20 points, b) 5 points, c) -10 points

Reducing

You can reduce your eco-footprint by shopping carefully. Buy in bulk to reduce packaging; buy refills (e.g. deodorants); choose well-made articles that will last well and those with recycled content; and avoid over-packaged products.

When you buy products do you:

a	Always think of the amount you will throw away	b	Often try – but take into consideration price and brand	c	Sometimes – depending on the price and brand	d	Never think of how goods are packaged or how long they will last
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Your score: a) -10 points, b) 0 points, c) 5 points, d) 20 points

WHAT YOUR SCORE SAYS ABOUT YOU

Add up all your points. How big is your ecological footprint?

Score less than 50: Green footprint (you have a tiny ecological footprint)

Score between 51 and 110: Yellow footprint (you have a small ecological footprint)

Score between 111 and 180: Blue footprint (you have a medium ecological footprint)

Score between 181 and 200: Orange footprint (you have a large ecological footprint)

Score over 200: Red footprint (you have a huge ecological footprint)

SOURCE

This activity is taken from the lesson plans developed by the Water Research Commission in partnership with Share-Net (A project of the Wildlife and Environment Society of South Africa). To download the full lesson (free of charge) go to:

www.wrc.org.za/downloads/education/school%20lesson%20plans/Grade10_Activity5.pdf

International Conference Held to Aid Environment


The 2009 International Conference on the Implementation of Environmental Water Allocations (IEWA) was successfully concluded in Port Elizabeth in February. The conference drew more than 400 delegates from 30 countries, including China, Thailand, the USA, Australia and Canada.

Research has shown that the demand on South Africa's scarce water resources (including rivers, wetlands, estuaries and groundwater) is increasing. At the

same time, there is an overall deterioration of the quality of the country's water resources. Sustainable aquatic ecosystems rely on the availability of water of adequate quantity and quality.

The conference aimed to identify and critique present global trends in the implementation of environmental water allocations in the fields of policy and legislation, integrating aquatic ecosystem protection with socio-economic growth and development, defining and

involving stakeholders; decision-making for sustainable use; operational management of water allocations; and sharing knowledge and skills.

IEWA was organised jointly by the Water Research Commission and the Department of Water Affairs & Forestry with the support of the International Union for Conservation of Nature, International Association of Hydrological Sciences and Chartered Institution of Water and Environmental Management. 



Conference chair Dr Stanley Liphadzi welcomes delegates at the opening of the conference.



The WRC exhibition stand proved to be popular.



Above: Dr Jackie King, principal research officer in the Freshwater Research Unit at the University of Cape Town, was one of the key speakers at the conference.



Left: The friendly sound of the xylophone greeted delegates at the start of the conference.



Right: One of the star attractions at the conference was the model of the twin-channel vertical-slot fishway developed by Dr Anton Bok and others with funding from the WRC.



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Alternatively details can be found at:

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Water Research Commission



The Water Research Commission (WRC) is South Africa's dynamic hub for water-centred knowledge, innovation and intellectual capital. The WRC provides leadership for water research development in:

- Water Resource Management
- Water-Linked Ecosystems
- Water Use and Waste Management
- Water Utilisation in Agriculture
- Water-Centred Knowledge

Impact areas address the following key issues:

- Water and Society
- Water and Economy
- Water and the Environment
- Water and Health

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